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PALEONTOLOGY.—*Emendation of the foraminiferal genera* Ammodiscus *Reuss, 1862, and* Involutina *Terquem, 1862.* Alfred R. Loeblich, Jr., and Helen Tappan, U. S. National Museum.

While examining type species of foraminiferal genera, during preparation of the section on Foraminifera for the *Treatise on invertebrate paleontology*, the writers found some genera to be quite incompletely known and incorrectly understood. Inasmuch as some of the early illustrations and descriptions were generalized or inaccurate and some of the type specimens had not since been restudied, this was not surprising. Unfortunately, upon reexamination of the types and the literature some supposedly well-known genera were found to be synonymous with others and quite unlike what was commonly referred to the genus.

Most paleontologists would have stated that the genus *Ammodiscus* Reuss, 1862, was a very well-known genus and that there were no problems as to its type species, generic characters, or systematic position. That the exact opposite is true we have now learned. A century ago taxonomists were not held to as rigid rules of nomenclature as today, and those who deplore the present "arbitrary" and exacting rules would do well to consider the status of many genera and species described before the advent of the International Commission. Today, Reuss's genus would have had no validity, as he mentioned no species, nor did he cite an exact reference to earlier species. This fact led to a later erroneous designation of type species, as will be shown. A century ago, as well as much more recently, Foraminifera were not thought to be sufficiently high in the evolutionary scale to have many diagnostic characters, and forms were considered conspecific even when they had completely different wall composition. Species were placed in a single genus regardless of whether they were attached or free, calcareous, or agglutinated, septate or undivided, and irrespective of the position or even the number of apertures. Many later references to these early species thus may be similar to certain of these early illustrations but are too often completely unlike the original type specimens. In the case of type species for genera this can have far-reaching effects. The type species of the genus *Ammodiscus* is here shown to belong to *Spirillina*, and thus not only does the genus become a junior synonym, but as it belongs to an entirely different systematic position, it must leave the family Ammodiscidae and subfamily Ammodiscinae for which it was considered the type genus.

Genus **Ammodiscus** Reuss, 1862, emended

Original reference.—Sitzb. Akad. Wiss. Wien, math.-nat. Cl., Jahrg. 1861, **44** (Abt. 1): 365. 1862.

Types species.—Orbis infimus Strickland, 1846. Fixed by subsequent monotypy: Bornemann (1874, p. 725).

Emended diagnosis.—Test free, discoidal, consisting of a globular proloculus followed by a planispirally coiled or very slightly trochoid tubular second chamber; wall calcareous, composed of a single crystal of calcite, occasionally irregularly fibrous in appearance in cross-section; aperture at the open end of the tube.

Discussion.—Reuss (1862, p. 365) described the genus *Ammodiscus* but named no species in the original reference. In his synonymy he included "*Cornuspira* Will. z. Thl.; *Trochammina* Park. et Jon. z. Thl.," but he mentioned no species within these two genera. Cushman (1910, p. 73) designated *Operculina incerta* d'Orbigny, 1839, Recent of Cuba, as the type species of the genus. Galloway (1933, p. 97) stated "... Reuss said, '*Cornuspira* Will. z. Th; *Trocham-*

mina Park. et Jon. z. Th.' Parker and Jones had the variety *T. squamata incerta* (d'Orb), which Reuss' description fits, and since it was one of original species and has been designated, it is the valid genotype." Parker and Jones (1859, p. 347), in their original description of *Trochammina*, mentioned only *Nautilus inflatus* Montagu but stated that "in deeper water it is represented by attenuated varieties, ultimately becoming *Spirilline*." They cited no "spirilline" species, however. This is perhaps the reference to which Reuss referred in his synonymy, for although he makes no definite citation of this reference under his discussion of *Ammodiscus*, he does cite the reference several times elsewhere in his article. Jones and Parker (1860, p. 304) (n.b. not Parker and Jones) cite the following species under *Trochammina: Rotalia inflata* Montagu (cited as type species), *T. irregularis* (=*Webbina irregularis* d'Orbigny), *T. irregularis alternans*, *T. irregularis clavata* (the type species of *Ammolagena* Eimer and Fickert, 1899), *T. squamata*, *T. squamata incerta* (d'Orbigny) (cited by Cushman, 1910, p. 73, as type of *Ammodiscus* Reuss, 1862), *T. squamata charoides* (a *Glomospira*), *T. squamata gordialis* (type species of *Glomospira* Rzehak, 1888), and *T. squamata inflata*.

Thus Jones and Parker placed under *Trochammina* at least five distinct genera, belonging to at least four different families. This reference is perhaps the one referred to by Galloway (1933, p. 97) inasmuch as it is the only reference of this early date citing *T. squamata incerta* (d'Orbigny). It should be kept in mind, however, that this reference is by Jones and Parker and not Parker and Jones, and thus it is doubtful that Reuss referred to it. Cushman therefore was in error in citing *Operculina incerta* d'Orbigny as type of *Ammodiscus*. As no original species were mentioned by Reuss, Galloway was also in error in stating that since *T. squamata incerta* (d'Orbigny). ". . . was one of the original species and has been designated, it is the valid genotype." In such a case, where Reuss described the genus *Ammodiscus* without naming a species, the first species to be placed in *Ammodiscus* becomes ipsofacto the type species of the genus and no subsequent designation can alter this fact.

The earliest name used in conjunction with *Ammodiscus* was *Ammodiscus lindahli* Carpenter and Jeffries (1871, p. 160). The only mention of this species, however, was given under the discussion of the dredgings under the report for July 29. Samples were obtained from 364 and 322 fathoms (*Porcupine* stations 26 and 27). They list various mollusks, etc., which were found and state: "But the most remarkable novelty here obtained was a large collection of thin sandy disks, from 0.3 to 0.4 inch in diameter, with a slight central prominence; for these proved on subsequent examination to contain an entirely new type of Actinozoon, extraordinarily flattened in form, and entirely destitute of tentacles. Dr. Carpenter, by whom this curious organism will be described, has assigned to it the name of *Ammodiscus lindahli*." Apparently this mention was not intended to be a specific description as it was stated (p. 161), "The quantity and variety of Zoological materials is so great that we have distributed it as follows: . . . and the *Pentacrinus*, *Ammodiscus* and Foraminifera by Dr. Carpenter. . ." It is interesting to note that Carpenter and Jeffries did not consider this to be a foraminifer but an "Actinozoon." Thus this is a homonymous usage of the name *Ammodiscus* for an actinozoan (anthozoan) and was not considered a reference to a foraminifer nor to *Ammodiscus* Reuss. *Ammodiscus lindahli* thus cannot be used as a type species for the foraminiferal genus *Ammodiscus*.

The next species cited in connection with *Ammodiscus* is *Ammodiscus infimus* (Strickland) Bornemann (1874, p. 725) (= *Orbis infimus* Strickland, 1846). As this is the first valid reference citing a species of *Ammodiscus* it automatically becomes the type species of *Ammodiscus*. Strickland's types are in London, the lectotype (designated by Barnard, 1952) (Cat. no. P 40870) and paratypes (Cat. no. P 40871) separated from the original type rock specimen (Cat. no. 32718) are in the British Museum (Natural History), and topotypes in the collections of the Geological Survey and Museum (no. 73204–5 and slides nos. 90171–78), also in London. These types were examined and redescribed by Barnard (1952, p. 905) and were shown to belong to *Spirillina* Ehrenberg, 1843, as they are hyaline, calcareous forms. As its type species is thus a *Spirillina* the genus *Ammodiscus* Reuss, 1862, is a junior synonym of *Spirillina* Ehrenberg, 1843, and therefore must be suppressed.

Actually, even if the species cited as type by Cushman (*Operculina incerta* d'Orbigny) were to be kept as type species by an appeal to the international Commission, the genus would still

have no standing. D'Orbigny's types of *Operculina incerta* were examined by the writers in Paris and found not to be an agglutinated form but a calcareous imperforate form and a typical *Cornuspira* Schultze, 1854. Three syntypes of d'Orbigny's species are preserved in the collections of the Muséum National d'Histoire Naturelle in Paris. That here figured (Figs. 1*a*, 1*b*) is hereby designated the lectotype of *Operculina incerta* and the remaining two specimens become paratypes. All are from the Recent of Cuba. All three specimens of *Operculina incerta* in the d'Orbigny collection are imperforate calcareous forms and thus not in the least similar to what has for many years been considered *Ammodiscus*. It is interesting to note that d'Orbigny's description of the species made no mention of it being arenaceous, as has been later assumed. He had commented only that its slight degree of transparence made it difficult to study the structure. Normally an arenaceous test would not be expected to show any transparence, which might also have suggested that d'Orbigny was not referring to an agglutinated form but to a porcellanous one.

This suppression of the generic name *Ammodiscus* as a synonym of *Spirillina* would seem to leave nameless those planispiral agglutinated forms commonly placed in *Ammodiscus*. Nevertheless, an examination of Terquem's types shows that the genus *Involutina*, as represented by its type species *I. silicea* Terquem, is an agglutinated form and does not have partial internal septa, but is completely undivided internally. The diagrammatic figures of Terquem interpreted as showing partial septa represent merely the slight undulations of the surface usually considered as growth wrinkles. Thus the species previously considered as *Ammodiscus* will fall in the genus *Involutina*, which therefore does not belong to the Silicinidae: This problem is further discussed under the generic emendation of *Involutina* which follows.

As the type species of *Ammodiscus*, *Orbis infimus* Strickland, has recently been well defined by Barnard, we have not redescribed the species here. However, the species *Operculina incerta* d'Orbigny, cited erroneously as type for *Ammodiscus* by Cushman, has never been accurately defined, and an emendation of this species follows, although it belongs with *Cornuspira* rather than with *Ammodiscus*.

Cornuspira incerta (d'Orbigny), emended

Figs. 1*a*, 1*b*

Operculina incerta d'Orbigny, 1839, *Foraminifères*. In: Ramon de la Sagra, Hist. Phys. Nat. île Cuba: 49.

Emended diagnosis.—Test free, discoidal, consisting of a globular proloculus and long undivided tubular planispiral second chamber forming about 12 coils, with succeeding whorls partially overlapping those preceding; wall calcareous, imperforate; aperture at the open end of the tube.

Greatest diameter of lectotype 1.36 mm, least diameter 1.13 mm, greatest thickness 0.25 mm.

Types and occurrence.—Three syntypes of d'Orbigny are preserved in the collections of the Muséum National d'Histoire Naturelle in Paris. That here figured is here designated as lectotype, the remaining two specimens becoming paratypes. All are from the Recent of Cuba.

Remarks.—As mentioned under the emendation of *Ammodiscus*, this species has been cited (although erroneously) as the type species of *Ammodiscus*. The types of the species show it to belong to *Cornuspira* Schultze, 1854.

Family Tolypamminidae Cushman, 1929

Cushman first used the name Tolypammininae for a subfamily of the family Ammodiscidae Reuss, 1862. As *Ammodiscus* has been shown to be a junior synonym of *Spirillina* Ehrenberg, 1843, it is removed from the family previously called Ammodiscidae, and hence that family name must be removed with it. As subfamily and family names are considered of equal importance for purpose of priority, the next available name for this family is therefore the Tolypamminidae.

Subfamily Involutininae Cushman, 1940

The subfamily Involutininae will include those genera previously placed in the Ammodiscinae—namely the free forms which have a globular proloculus and long undivided tubular second chamber, either in a planispiral or trochoid coil, and cannot be used as a subfamily of the Silicinidae.

Genus **Involutina** Terquem, 1862

Original description.—Mém. Acad. Imp. Metz, ann. 42 (ser. 2, ann. 9), 1860–1861: 450. 1862.

Types species.—*Involutina silicea* Terquem, 1862. Monotypic.

Diagnosis.—Test free, discoidal, with proloculus followed by an undivided planispiral tubular chamber, which slightly overlaps preceding whorls at the lateral margins, occasional irregular surficial transverse constrictions possibly denoting stages of growth, but without internal septa; wall finely agglutinated, of sand grains with considerable cement; aperture at the open end of the tube.

Discussion.—As noted under the emendation

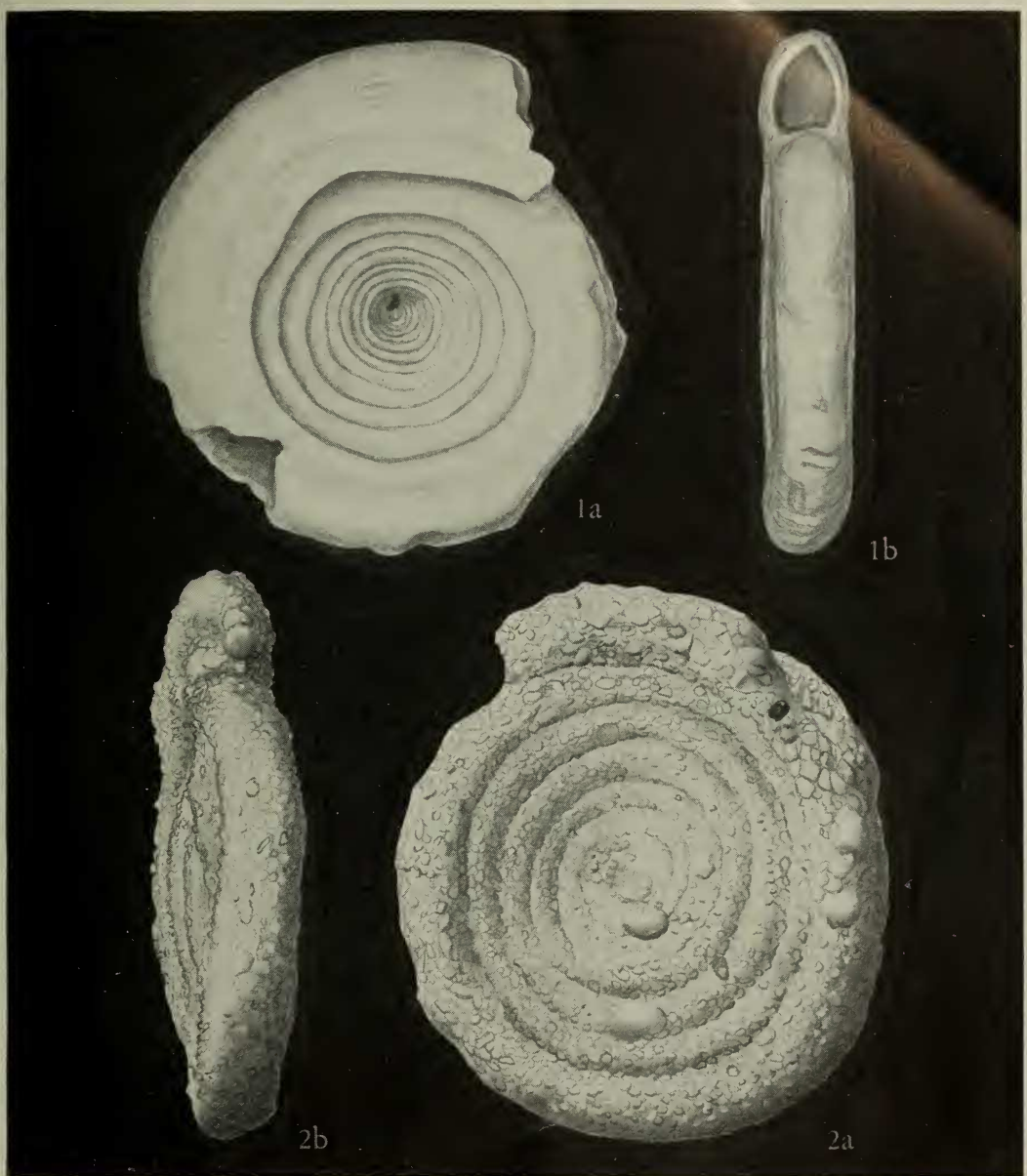

Fig. 1.—*Cornuspira incerta* (d'Orbigny), lectotype, Muséum National d'Histoire Naturelle, Paris, Recent of Cuba: 1*a*, Side view, showing planispiral calcareous test; 1*b*, edge view, showing aperture at open end of the tube. × 53. Camera-lucida drawings by Helen Tappan Loeblich.

Fig. 2.—*Involutina silicea* Terquem, lectotype, Muséum National d'Histoire Naturelle, Paris, Lias Moyen, St. Julien-les-Metz, France: 2*a*, Side view, showing nonseptate, planispiral agglutinated test; 2*b*, edge view. × 65. Camera-lucida drawings by Lawrence Isham, scientific illustrator, Smithsonian Institution.

of *Ammodiscus* the genus *Involutina* is not subdivided internally, and in fact represents the form previously referred to *Ammodiscus*. This is not a completely unlooked-for discovery, as Macfadyen (1941, p. 17) stated that specimens sent to Brady by Terquem and in the Brady collection at the British Museum (Natural History), London, and which are labelled *Involutina* (*Cornuspira*) *silicea* Terquem, Lias Moyen, Metz, were "... all of the form that I have identified as *Ammodiscus asper* (Terquem)." On this basis Macfadyen stated that *Involutina* was probably a synonym of *Ammodiscus*, subject to confirmation by the type species. The types also are planispiral, agglutinated, undivided forms and thus the generic name *Involutina* must be used for those species previously referred to *Ammodiscus*, as *Ammodiscus* itself is found to be synonymous with *Spirillina*.

Involutina silicea Terquem, emended
Figs. 2*a*, 2*b*

Involutina silicea Terquem, Mém. Acad. Imp. Metz, ann. 42 (ser. 2, ann. 9), 1860–1861: 450. 1862.

Emended diagnosis.—Test free, discoidal; proloculus followed by an undivided planispiral tubular chamber forming about seven or eight coils which are slightly overlapping at the lateral margins, crossed by occasional irregular surficial growth constrictions, but completely lacking any internal septa or subdivisions; wall finely agglutinated, composed of quartz grains embedded in a large amount of cement; aperture at the open end of the tube.

Greatest diameter of lectotype 1.18 mm, least diameter 0.95 mm, greatest thickness 0.23 mm.

Types and occurrence.—Lectotype (here designated) and paratypes in the Muséum National d'Histoire Naturelle, Paris. All are from the Lias Moyen, St. Julien-les-Metz, France.

Remarks.—This species is the type species of *Involutina* Terquem. The transverse growth wrinkles were interpreted by Terquem as septa. Actually they are not reflected on the interior of the shell. As the type species of *Ammodiscus* Reuss, 1862, has been shown to be a hyaline calcareous form, Reuss's genus is a synonym of *Spirillina*. As *Involutina* is shown to be an agglutinated non-septate planispiral form, the agglutinated species formerly included in *Ammodiscus* by later authors should correctly be placed in *Involutina*.

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